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(54) DRUM-TYPE DOMESTIC MACHINE FOR DRY CLEANING

(71) We, BOSCH-SIEMENS HAUSGERATE GmbH, a German company of Stuttgart, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a drum-type domestic machine for dry cleaning textile articles.

In commercial dry-cleaning installations, it is the main endeavour to achieve high-speed cleaning processes. Thus, there are employed in such installations cleaning liquids the boiling point of which is already within the normal room temperature range. For this purpose, however, it is necessary to provide an outlay from the apparatus-technical aspect which is unacceptable (for reasons connected both with space requirements and costs) for a domestic machine for dry-cleaning, even if a reduction in proportions is effected. For example, the temperature of the cleaning liquid in the supply container must always be kept far below its boiling temperature. Furtherfore, before commencement of each cleaning process, negative pressure must be generated in the cleaning chamber in order that the pressure increase caused during the cleaning process, due to vaporisation of the cleaning liquid, may not generate an excessively high degree of positive pressure in the cleaning chamber. If this were not done, excessively large leakage losses might reduce the supply of cleaning liquid with impermissible rapidity.

For the reasons stated hereinabove, it is not possible, on application to domestic machines for dry-cleaning, to have recourse to a concept based on known commercial dry-cleaning installations.

According to the present invention, there is provided a drum type domestic machine for dry-cleaning textile articles which comprises:

a housing;

a rotatable drum provided in said housing and being sealable fluid-tight therein;

a hollow journal forming at least part of a mounting for the rotatable drum;

a perforated partition in said drum defining first and second chambers therein said first chamber comprising a cleaning chamber for textile articles, and said second chamber being also defined by an end wall of the drum;

a cleaning fluid supply arrangement having a supply line extending through said journal, and a spray head communicating with said supply line for delivering said fluid into said first chamber;

a suction discharge arrangement for soiled cleaning fluid comprising a discharge line extending through said journal, and a suction line communicating with said discharge line and extending to an intake region for soiled cleaning fluid, which region is adjacent the shell of the drum and, in use, constitutes a lowest region of the drum into which the soiled fluid tends to collect;

a supply container for cleaning fluid;

a delivery pump communicating with said supply container and with said supply line;

and a suction pump communicating with said discharge line and with said supply container, the communication with said supply container being *via* a filter, a distilling device and a condenser.

Conveniently, the machine need not deviate from standard dimensions determined for domestic devices of this or similar kinds. Furthermore, it may be possible to obtain the largest possible number of elements from already-existing washing machine manufacture. Since a complete cleaning process may, in the case of a

domestic machine according to the invention, reasonably take longer than in the case of commercial devices of this kind, there may be employed a cleaning liquid hvaing a boiling temperature which is above normal room temperature but is, nevertheless, still far below the boiling point of water. For the same reason, a centrifuging step, conventional in commercial devices for drying the cleaned textile materials, may be dispensed with. On the other hand, for drying purposes, the drum chamber may be heated and the cleaning liquid evaporated or vaporised.

The following further features may advantageously be employed, either individually or in combination with each other, in the domestic machine according to the invention.

Conviently, the suction tube may be arranged in the second chamber, and therefore also the intake region, so that the suction tube will not be exposed to the textile articles in the first chamber.

The drum comprises a non-cylindrical body of rotation and the largest dimension thereof is adjacent the intake region of the suction tube.

If, in fact, the drum comprises for example a truncated cone having a horizontal axis, the soiled cleaning fluid (liquid) accumulates precisely at the location at which the suction tube ends.

The same effect can be achieved if the drum is of cylindrical design and is obliquely mounted.

The partition is, in the direct vicinity of the spray head, bulged annularly in such manner as to project into the first chamber or inner space of the drum. Thereby, it becomes possible to prevent the textile materials displaced in the drum from passing, as they slide past, into the gap necessarily provided between the spray head and the partition.

If a closure lid is, in the case of a domestic machine having a frontally charged drum, a co-rotating component of the drum and, in the closed condition, seals off the drum aperture in fluid-tight manner, it then becomes possible to dispense with a costly sealing structure having a non displaceable lid.

For heating the drum interior, there may advantageously be arranged on the drum jacket an electrical heating mat the electrical supply line of which extends over sliprings at a bearing forming a further part of the mounting for the drum.

An outflow aperture for a cleaning intensifier container may debouch into the supply line for the cleaning liquid. Thereby, it becomes possible, for special cleaning programmes, to admix a cleaning intensifier to the cleaning liquid.

In order that the cleaning intensifier may be supplied in the desired concentration during the entire cleaning process, the cleaning intensifier container may be designed as a supply container having a dosing device and a dropping device.

A storage container may be inserted upstream of the distilling device in the direction of flow. Due to this device, it is possible to design the vaporisation capacity of the distilling device for a period of time extending from the commencement of cleaning up to the end of the subsequent drying process. The quantity of cleaning liquid to be distilled arriving during the cleaning process can then be processed by the distilling device during this period of time. Thus, the storage container may advantageously be employed for intermediate receiving and storing of the excessive quantity of cleaning liquid arriving up to the instant of processing during the drying process.

The invention will now be described in detail below, by way of example only, with reference to the accompanying diagrammatic drawing of one embodiment of domestic machine according to the invention.

The domestic machine comprises a housing 1 and a base 2 having legs 3. At the front side of the housing is a charging aperture which can be sealed by a door 4. A bearing plate 5 secured on the base 2 of the housing carries the drive motor 6 for a drum 7. Via a V-belt 8, the motor drives a belt pulley 10 secured on the bearing journal 9 of the drum 7. The journal is mounted by means of ball bearings 11 in the bearing plate 5 and carries the drum 7. As means for supporting the free end of the drum, there is employed a bearing 111 secured to the housing 1.

The drum 7 comprises a cylindrical shell having a rear wall 12 and a front wall 13. Formed in the front wall is a charging aperture adapted to be sealed gas-tight by a cover or lid 14. Furthermore, there is inserted into the drum 7 an intermediate wall or partition 15 perforated in the marginal zone and arranged so as to define first and second chambers in the drum, the first chamber comprising a cleaning chamber for textile articles and the second chamber also being defined by the rear wall of the drum. Arranged in the centre of the partition—protected by an annular concentric "bulge" 16 — is a stationary spray head 17 connected with a supply line 18 for the cleaning liquid. The supply line 18 extends, together with a discharge line 19, through the hollow journal 9 which, by means of a packing 20, seals off the inner chamber of the drum relative to the external atmosphere. Connected to the dis-

charge line 19, in the drum 7, is a suction tube 21 which extends within the second chamber and has an intake region at the lowest location of the drum into which soiled cleaning liquid tends to collect in use.

In order that the largest possible part of the cleaning liquid dripping off from the textile materials to be cleaned in the drum may be taken up by the suction tube 21, it is to be recommended to employ a special drum construction or mounting (not shown). For example, the drum 7 may be designed to be slightly conical, so that the suction tube 21 dips into the drum at the lowest location, i.e. at the location of maximum radius. However, it is more expedient and less costly to provide a cylindrically constructed drum 7 which in contradistinction to what is shown in the drawing, is however mounted to be not horizontal but inclined rearwardly to a slight degree. Thus, there is then again afforded for the location of suctional removal through the tube 21 a lowest location at which the cleaning liquid which drips off accumulates.

For the sake of clarity, the domestic machine means which hitherto have not been described are shown externally of the housing 1. In the construction of the device, however, the space below the drum may be used therefor.

Connected with the supply line 18 is a delivery pump 22 driven, together with a suction pump 23 connected to the suction or discharge line 19, by a motor 24. The delivery pump 22 is connected, via an electrically actuable valve 25, with the outlet or drain of a supply container 26 for the cleaning liquid. The supply container has an overflow 27. Furthermore, there is provided in an inner chamber a condenser 28 having a discharge aperture 29 and which is connected to a distilling device 30. The distilling device is connected, via an electrically actuable valve 31 and a filter 32, to the suction pump 23. The filter 32 is adapted to be bridged-over by a valve 33 which is also electrically actuable.

Additionally, there may be connected to the supply line 18, via an actuable valve 34, a cleaning intensifier supply container 35. Via a supply means 36, the cleaning intensifier may be miscible with fresh water. In order to guarantee uniform inflow of the cleaning intensifier into the supply line 18 during the entire cleaning process, the cleaning intensifier supply container 35 may be provided with a dosing device and a dropping device (not shown).

The cleaning liquid may be a fluorinated-chlorinated hydrocarbon, the boiling temperature of which is approximately 47°C.

For cleaning textiles, the cleaning liquid is delivered by the delivery pump 22, through the supply line 18 and the spray head 17, into the inner chamber of the drum. Due to intensive movement of the textile materials in rotation of the drum 7 at a speed of for example 50 rpm (which, if so required, may also be reversing), the textile materials are intensively cleaned for approximately ten minutes. During the entire cleaning process and, furthermore, during the subsequent drying process, the consumed cleaning liquid or the vapour thereof is conveyed by the suction tube 21, via the discharge line 19 and the suction pump 23, to the filter 32. If the filter 32 contains a single cartridge, the cleaning liquid is freed from the insoluble dirt particles and is subsequently conveyed into the distilling device 30. There, due to distillation the soluble dirt components are removed out of the cleaning liquid. These dirt components can be discharged through a drain valve arranged at the base of the distilling device. On employing a filter 32 having an active carbon insert, it is there possible to remove even a considerable portion of the soluble dirt components out of the cleaning liquid. Thereby, an improved cleaning effect and also facilitated manipulations during cleansing of the domestic machine are achieved, since the residues of soluble dirt components in the distilling device 30 are diminished. The vapour of the cleaning liquid then passes into the condenser 28 arranged in the supply container 26 and, after condensation, flows back through the drain 29 into the supply container.

Since, for cleaning in the domestic machine described above, there is advantageously employed a cleaning liquid the boiling point of which, although substantially above the normal room temperature, is nevertheless substantially below the boiling temperature of the water, it becomes possible to dispense with separate cooling of the supply container. The cooling effect achievable with appropriate construction of the supply container (lamination, cooling ribs) should be adequate to liquefy the cleaning agent vapour in the condenser. If, however, in individual cases it should happen that the cooling effect thereby achievable is not yet adequate, then it will be possible, without any very considerable outlay, to arrange a correspondingly dimensioned cooling unit (not shown) in the supply container, or a supplementary cooling fan.

The cleaning process is followed by a drying process. In the case of commercial dry-cleaning installations, initially centrifuging is effected at a speed of approximately 400 rpm, so as to remove the

cleaning liquid out of the textile materials with maximum rapidity. In the case of the domestic machine, however, a centrifuging step can be completely dispensed with, because the cleaning liquid employed therefor readily vaporises on heating being effected and an extremely short process duration is unnecessary in the household, as compared with commercial installations. The fact that centrifuging is dispensed with has two important advantages. Thus, since the drum will not be required to rotate at high speeds to effect centrifuging, it will not be necessary to design the drum and its mountings to take into the account the possibility of high inbalance forces being generated. Therefore, the construction can be mechanically smaller and less costly. A further important prerequisite for a successful cleaning process is the possibility to employ a large drum since only small inbalance forces will be generated.

For heating the drum inner chamber, there is provided an electrically heated mat 37 secured, in a manner which is not shown, to the drum shell and which can be supplied with electrical energy via a pair of sliprings 38 and electrical lines (also not shown) which may be secured to the outer walls of the drum 7 e.g. by adherence thereto.

The drum inner chamber can, with the aid of the heating mat 37, be heated to for example 60°C, whereby positive pressure is set up on vaporisation of the cleaning liquid in the drum. Since, during the drying process, the valve 25 is (according to prerequisite) closed, the cleaning agent vapour is able to escape only through the suction tube 21 and the discharge line 19, with the assistance of the suction pump 23, into the distilling device 30. During this procedure, the valve 33 is open, since it will be unnecessary to expect in the escaping cleaning agent vapor any unsoluble dirt components requiring to be separated-off in the filter 32. After liquefaction in the condenser 28 the cleaning agent passes back into the supply container 26. After completion of the drying process, the valves 25 and 31 are closed, in order that the supply container may, with the domestic machine inoperative, be sealed relative to the environment.

For completely automatic control of the cleaning and drying process, there is provided a control device 39 which, here, is not discussed in detail.

The cover or lid 14 of the drum 7 can be pressed, by devices (not shown), against an edge seal of the charging aperture of the drum. During operation, the cover corotates. In order to avoid any risk of injury, the cover 14 is covered by the door 4, which is equipped with a safety device for halting the drum on the door being opened. Additionally, the cover is provided with a latching or locking device preventing opening of the cover for as long as the drum inner chamber is under pressure (due to vaporisation of the cleaning fluid). Since such safety devices are already known, more detailed discussion thereof will be dispensed with.

If the cover 14 is secured by means of hinge elements arranged to be fast on the drum, after completion of most of the cleaning processes, the operating handle of the cover will remain at a standstill in a disadvantagous operating position. There is already known from jacket-charged automatic washing machines a so-called "parking automatic system" the effect of which is that the drum cover always remains in the correct operating position after termination of the full programme. Such a "parking automatic system" could be employed also in the domestic machine according to the invention. On the other hand, it would also be possible to provide instead of such an arrangement a push button which during normal operation is covered by the door 4 and with the aid of which the drum rotor 6 can be momentarily cut in, whereby the cover can be put into an advantageous operating position.

The heating mat 37 covering the drum shell or drum jacket may consist of etched foil elements or of an arrangement produced by winding the drum with heating wires. For thermal insulation, the heating mat is externally covered with an insulating layer.

For reasons connected with costs, the motor 24 for driving the two pumps 22 and 23 may be dispensed with, and the pump may be connected to be driven by the shaft of the main motor 6.

In order that the vaporisation capacity of the distilling device 30 need not be designed to cope with the large quantity of cleaning liquid arriving during the cleaning process, (the distilling device then being out of operation during the entire drying process during which the cleaning agent is already flowing in gaseous form to the distilling device) the vaporisation capacity may be designed to be lower and the distilling device may then be operative also during the drying process. For taking up the meanwhile excessive quantity of cleaning liquid to be distilled, a storage container (not shown) may be provided between the valve 31 and the distilling device 30.

If water is required for mixing a cleaning intensifier added to the cleaning liquid, it will be expedent to employ a water separator. However, since in the present case the specific gravities of the cleaning liquid and of the water differ substantially

from each other, it will be possible to dispense with a special device for this purpose. In fact, it will suffice to provide the supply container with an overflow 27, since the specific gravity of water is lower than that of the cleaning agent employed. In order that for example cleaning liquid introduced in excess may not also escape over the overflow, flow-out out of the overflow may be controlled by a water indicator in the overflow zone level.

It should be understood that the scope of protection for this invention is defined in the appended claims, and that the invention is not limited to the example of embodiment shown. In particular, the drawing of the example of embodiment is, due to its diagrammatic form, to be understood to constitute merely an elementary diagram.

WHAT WE CLAIM IS:

1. A drum-type domestic machine for dry cleaning textile articles which comprises:

a housing;

a rotatable drum provided in said housing and being sealable fluid-tight therein;

a hollow journal forming at least part of a mounting for the rotatable drum;

a perforated partition in said drum defining first and second chambers therein, said first chamber comprising a cleaning chamber for textile articles, and said second chamber being also defined by an end wall of the drum;

a cleaning fluid supply arrangement having a supply line extending through said journal, and a spray head communicating with said supply line for delivering said fluid into said first chamber;

a suction discharge arrangement for soiled cleaning fluid comprising a discharge line extending through said journal, and a suction line communicating with said discharge line and extending to an intake region for soiled cleaning fluid, which region is adjacent the shell of the drum and, in use, constitutes a lowest region of the drum into which the soiled fluid tends to collect;

a supply container for cleaning fluid;

a delivery pump communicating with said supply container and with said supply line;

and a suction pump communicating with said discharge line and with said supply container, the communication with said supply container being *via* a filter, a distilling device and a condenser.

2. A domestic machine according to claim 1, in which the suction pipe extends within said second chamber.

3. A domestic machine according to claim 1 or 2, in which the drum comprises a non-cylindrical body of rotation and has a maximum dimension adjacent the intake region of the suction tube.

4. A domestic machine according to claim 1 or 2, in which the drum is of cylindrical construction and is mounted with its axis oblique.

5. A domestic machine according to any one of the preceding claims, in which the partition is annularly bulged, adjacent the spray head and projects into the first chamber of the drum.

6. A domestic machine according to claim 5, having a frontally loaded drum, in which a closure cover of the drum is a co-rotating component of the drum and, in the closed condition, hermetically seals off the loading aperture of the drum.

7. A domestic machine according to claim 5 or 6, in which there is arranged on the drum shell an electrical heating mat the electrical supply line of which extends *via* slip rings arranged at a bearing forming a further part of the mounting of the drum.

8. A domestic machine according to claim 6 or 7, in which an outflow aperture of a cleaning intensifier container debouches into the supply line for the cleaning fluid.

9. A domestic machine according to claim 8, in which the cleaning intensifier container is designed as a supply container having a dosing device and a dropping device.

10. A domestic machine according to any one of the preceding claims, in which a storage container is inserted upstream, in the flow direction, of the distilling device.

11. A domestic machine according to claim 1 and substantially as hereinbefore described with reference to and as shown in the accompanying drawing.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.